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DRAFT
BIOVENTING TEST WORK PLAN FOR BUILDING 97- FLIGHTLINE FUEL PUMP HOUSE CHARLESTON AFB, SOUTH CAROLINA

Prepared for:

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
BROOKS AFB, TEXAS

and

HEADQUARTERS 437 AIRLIFT WING (AMC)
CHARLESTON AFB, SOUTH CAROLINA

October, 1993

Prepared by:
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1700 Broadway, Suite 900
Denver, Colorado

AQM01-03-0524

ENGINEERING-SCIENCE, INC.

401 Harrison Oaks Boulevard, Suite 210 • Cary, North Carolina 27513 • (919) 677-0080 • Fax: (919) 677-0118

October 11, 1993

Mr. Marty Faile
AFCEE/EST Building 642
8001 Arnold Drive
Brooks AFB, Texas 78235-5357

Subject: Draft Bioventing Work Plan
Building 97-Flightline Fuel Pump House
Charleston AFB, South Carolina

Dear Mr. Faile:

Enclosed are two copies of the Draft Bioventing Work Plan for Building 97-Flightline Fuel Pump House, Charleston Air Force Base, South Carolina. This Draft report serves as a site-specific addendum to the document "Test Plan and Technical Protocol for a Field Treatability Test for Bioventing."

After review by AFCEE and Charleston AFB personnel, comments will be addressed and incorporated into a Final Work Plan. ES would like to begin initial testing at this site no later than the week of November 8, 1993. As noted in the Draft Work Plan, the bioventing pilot study will not begin until demolition activities are completed at this site and the appropriate regulatory permits are obtained.

If you have any questions concerning this work plan or the proposed testing schedule, please call me at (919) 677-0080 or Mr. Doug Downey at (303) 831-8100.

Sincerely,

ENGINEERING-SCIENCE, INC.

S. Grant Watkins

S. Grant Watkins, P.G.
Site Manager

Enclosure

cc: Mr. Mark Smith (Charleston AFB)

CONTENTS

FIGURES

BIOVENTING TEST WORK PLAN FOR BUILDING 97-FLIGHTLINE FUEL PUMP HOUSE CHARLESTON AFB, SOUTH CAROLINA

1.0 INTRODUCTION

This site-specific work plan presents the scope of a bioventing pilot test for *in-situ* treatment of fuel-contaminated soils at the flightline fuel pump house located at Building 97, Charleston Air Force Base, South Carolina. For the purpose of this work plan, this area is designated as Building 97 Pump House. The proposed pilot test has three primary objectives: 1) to assess the potential for supplying oxygen throughout the contaminated soil depth, 2) to determine the rate at which indigenous microorganisms will degrade the fuel when stimulated by oxygen-rich soil gas, and 3) to evaluate the potential for sustaining these rates of biodegradation until fuel contamination is remediated below regulatory standards.

If bioventing proves to be a feasible technology for this site, pilot test data will be used to design a full-scale remediation system and to estimate the time required for remediating soils to regulatory standards. An added benefit expected during pilot testing at the Building 97 Pump House area is that a significant amount of the fuel contamination should be biodegraded during the one-year pilot test.

The pilot test system will involve two vertical air injection wells and a blower capable of sustaining a flow rate of at least 30 standard cubic feet per minute (scfm). Each vent well (VW) is expected to produce a radius of influence of approximately 20 to 30 feet, since this test site has a moderately high water table. The design flow rate and actual radius of influence for any one site will depend on soil properties, unsaturated soil thickness, and other factors. Rates of *in-situ* fuel biodegradation can also vary considerably and will be determined for individual soil vapor monitoring points (VMPs) that will be installed around the vent wells.

Additional background information on the development and recent success of the bioventing technology is found in the document entitled "Test Plan and Technical Protocol For A Field Treatability Test For Bioventing." This protocol document is a supplement to the site-specific work plan and it will also serve as the primary reference for pilot test well designs and detailed test objectives and procedures. Unless otherwise noted, test procedures outlined in the protocol document will be used during the pilot test at Building 97 Pump House.

2.0 SITE DESCRIPTION

2.1 Building 97-Flightline Fuel Pump House

2.1.1 Site Location and History

Flightline fuel pump house (Building 97) is a metal canopy partially covering the piping manifolds and fuel tanks. These structures are located beside Building 98, which houses the system controls. The fuel pump house system is located on the north side of the MAC Maintenance Apron adjacent to apron access Taxiway #4. A large

drainage ditch is located between the facility and Taxiway #4. The fuel pump house is part of the aircraft apron/taxiway fuel distribution system that receives aircraft fuels from bulk storage (via pipelines) on another part of the base and dispenses the fuel to fueling stations around the aircraft apron. Figure 2.1 shows the location of the Building 97 Pump House with respect to the base.

The Building 97 pumphouse fuel distribution system consists of six 50,000-gallon underground storage tanks (USTs), influent and effluent fuel filters, five oil/water separators, underground pipelines and piping manifolds, fuel pumps, and two small USTs for overflow and waste liquid collection and storage. Base personnel report that JP-4 jet fuel is the primary fuel distributed by this facility. Figure 2.2 shows the fuel distribution system layout at Building 97 and Building 98.

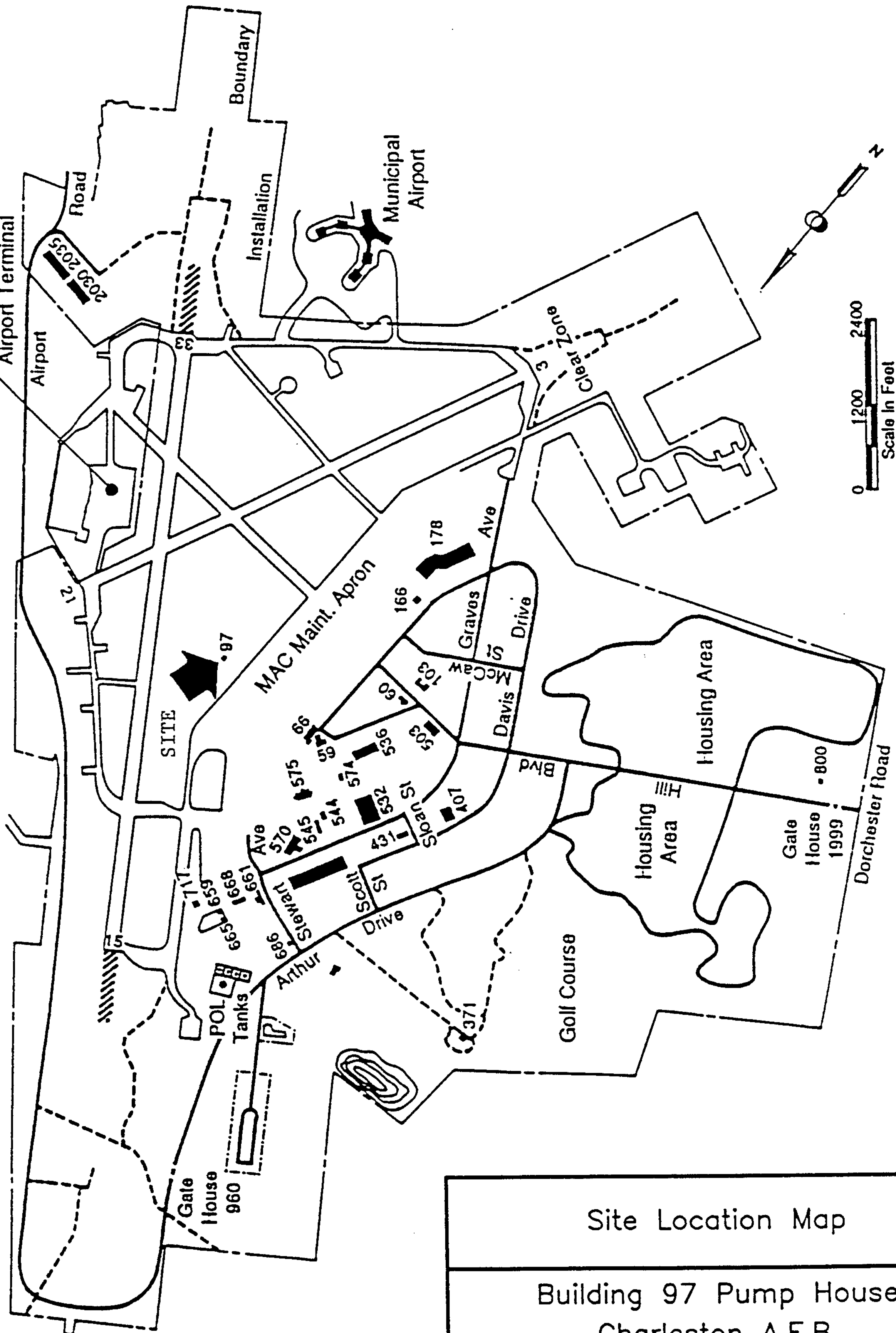
Charleston AFB is currently redesigning and upgrading their hydrant fuel distribution system at the ADAL aircraft apron. Part of this renovation project includes demolishing portions of the existing apron taxiway and fuel distribution facilities, including the system located at Building 97 Pump House. The base reports that the fuel distribution system located at Building 97 will be demolished by the end of October. Demolition of the facility will include removal of all USTs and ancillary piping, and demolition of above-ground and below-ground structures. A replacement fuel pump house will be built on another part of the apron taxiway.

2.1.2 Previous Investigations

Limited environmental assessments have been conducted at the Building 97 Pump House to date. Preconstruction geotechnical studies and preliminary environmental sampling were conducted by Westinghouse Environmental and Geotechnical Services, Inc. (Westinghouse) during August and September, 1991. The scope of the Westinghouse study included numerous geotechnical borings along the apron taxiway in the areas planned for demolition and/or renovation. In areas of environmental concern, limited soil sampling and analyses were performed. Soil samples were screened for organic vapors with a photoionization detector (PID) and were laboratory-analyzed for benzene, toluene, ethlybenzene, and xylenes (BTEX) during the Westinghouse study. No groundwater monitoring wells were installed during the investigation. Figure 2.3 shows the locations of the soil boring/sampling points.

During the Westinghouse study, eighteen soil borings were advanced in the vicinity of the Building 97 Pump House. Each of the samples were analyzed for BTEX constituents. Fourteen of these sampling points (B-P5 through B-P18) were located around the USTs and fuel filters on the east side of the flightline drainage ditch. The remaining borings (B-P1 through B-P4) were positioned around the delivery pipeline on the west side of the ditch. PID readings, some as high as 3,311 parts per million (ppm), were detected in most of the soil borings. BTEX constituents were also detected in samples collected near the water table from nine of the borings. The greatest total BTEX concentration was 81.8 ppm found in boring B-P14. Westinghouse reported that immiscible, liquid-phase product ("free product") was present in this boring, however, an estimated product thickness was not given. Results of these findings are provided in the Westinghouse report titled *Report of Geotechnical Engineering and Environmental Services, ADAL Apron/Hydrant Fuel System, Charleston Air Force Base* (November, 1991).

Figure 2.1



Site Location Map

Building 97 Pump House
Charleston A.F.B.
Charleston, South Carolina

Source: Versar, 1992

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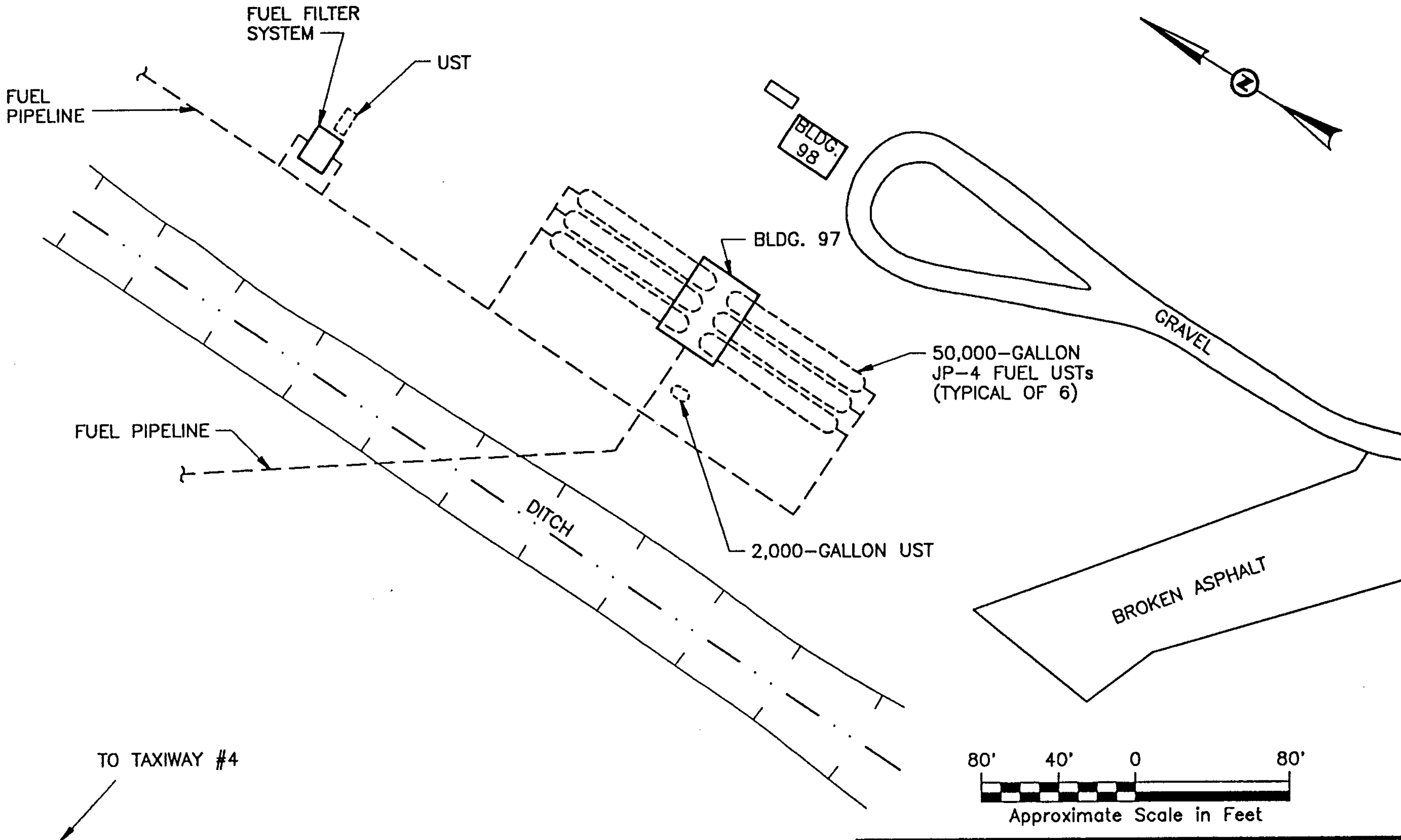

NOTES:

1. All above-grade and below-grade structures and USTs will be removed prior to installing the bioventing system.
2. All facility and appurtenance locations are approximated.

Site Plan

Building 97 Pump House
Charleston A.F.B.
Charleston, South Carolina

Figure 2.2

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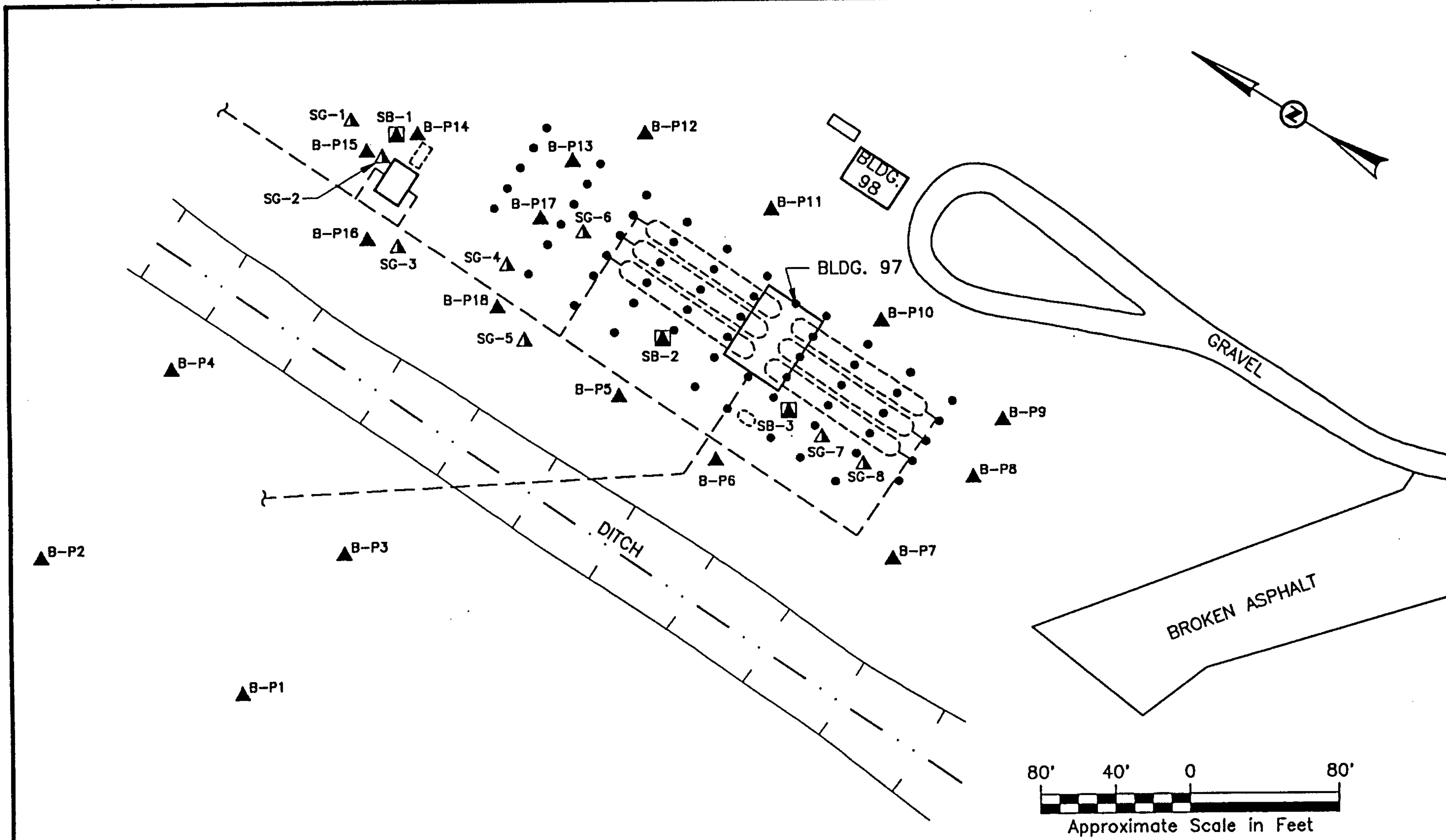

LEGEND

B-P15 ▲ Westinghouse soil boring.

SG-1 △ ES soil gas point.

SB-1 ES soil boring.

• Coastal Engineering soil boring/sampling point.

Soil Boring and Soil Gas Sampling Points

Building 97 Pump House
Charleston A.F.B.
Charleston, South Carolina

Figure 2.3

ES ENGINEERING-SCIENCE

ES conducted a preliminary soil gas/soil boring survey at Building 97 Pump House on February 18-19, 1993 as part of a base-wide search for candidate bioventing study sites. Eight shallow soil gas points and three shallow soil borings were installed to determine soil gas composition, fuel distribution, and lithologic characteristics. One of the soil borings (SB-1) was advanced to the water table adjacent to the boring location (B-P14) where Westinghouse had reported liquid-phase product. The boring installed by ES did not encounter liquid-phase product. Soil borings SB-2 and SB-3 were advanced to the capillary fringe, one on each side of the Building 97 canopy. Soil boring and soil gas test points installed by ES are illustrated in Figure 2.3.

ES accomplished the soil gas survey by using a nondedicated, retractable tip to collect soil gas samples at each test point. Soil gas sampling was attempted at multiple depths (3 feet and 5 feet) for tests points SG-1 through SG-3, but water was drawn into the sampling tubes at the 5-foot depth. The remaining soil gas points were then advanced only to depths of 2.5 to 3.0 feet below ground surface (bgs) to prevent drawing water into the sampling device. Soils in the vicinity of SG-7 and SB-3 were determined to be the most contaminated, having total soil gas hydrocarbon readings greater than 20,000 ppm. Soils in this area were also oxygen depleted (0%) and had elevated carbon dioxide concentrations (10%).

Additional soil sampling was performed by base contractors (Coastal Engineering, Inc.) in September, 1993 prior to and during the UST removals. Soil samples were collected around and beneath the USTs in a grid pattern for total petroleum hydrocarbons (TPH), BTEX, and naphthalene analyses. Detectable soil TPH concentrations ranged from 2.4 milligrams per kilogram (mg/kg) to 1,180 mg/kg. Additional analyses were performed to target jet fuel hydrocarbons using gas chromatograph (GC) analysis. Jet fuel hydrocarbon concentrations ranged from less than 10 mg/kg to 24,000 mg/kg on the samples analyzed by this method. The approximate locations of these soil boring/sampling points are shown in Figure 2.3.

The design of this test work plan is based solely on site data collected to date by Westinghouse, ES, and Coastal Engineering, Inc. Preliminary data suggest that the Building 97 Pump House site is a good candidate for bioventing, and the existing data are considered sufficient for designing the bioventing pilot study. Future sampling results and site conditions will be evaluated by ES prior to the bioventing system installation to determine any impact on the bioventing pilot test objectives, design, or procedures. Considerable soil disturbance is expected during the UST removals and demolition activities. Therefore, after the USTs are removed and prior to vent well installation, ES may perform further soil gas sampling to optimize the vent well locations.

2.1.3 Regional and Site Geology

Charleston AFB is located in the Lower Coastal Plain physiographic province of South Carolina. Sediments beneath the base are characterized as a thick sequence of interbedded sands, silts, and clays formed by fluvial and marine processes. These interbedded layers are grouped into regional formations and aquifers based on lithologic and water quality characteristics. Surficial soils around the Base are generally sandy

and highly permeable at shallow depths, but may contain zones of clay and organic deposits. The area is marked by low geomorphic relief.

The shallow stratigraphy at Building 97 Pump House consists of sands, silts, and clays of the Ladson Formation. The upper 10 feet is generally sands and silty sands. Geotechnical borings installed by Westinghouse indicate that this lithologic formation extends to a depth of approximately 43 feet bgs near the MAC maintenance apron. ES soil boring SB-1 encountered an isolated zone of silty clay and clayey sands in the upper 6 feet of the soil profile. This low permeability layer is apparently not continuous across the site, however, as fine to medium sands and silty sands were consistently observed in the other shallow soil borings.

The Ladson Formation forms the surficial, unconfined aquifer in the vicinity of the base. During February, 1993, groundwater was encountered at depths ranging from 6.5 feet bgs in ES soil boring SB-1 to 4.5 feet bgs at soil boring SB-2. The water table is typically highest in this region during the winter months and water levels observed during February, 1993 probably represent seasonal high water table conditions. To support this conclusion, ES documented anomolously-high water levels at another bioventing site on the base during this same month. The Westinghouse report suggested a water table depth of approximately 10 feet bgs during August, 1991. According to base personnel, field observations during one of the UST removals on September 23, 1993 indicated that the water table was greater than 8 feet bgs on that date. Seasonal water table fluctuations of several feet are common in this area and recharge to the surficial aquifer from precipitation events is rapid.

Two 4-inch diameter vertical air injection wells, four multi-depth VMPs, and one temporary background monitoring point will be installed at the test site. No groundwater monitoring wells currently exist at the site for potential use as vapor monitoring points. Because the bioventing technology is applied to unsaturated soils, the thickness of the soil treatment zone is expected to vary on a seasonal basis due to water table fluctuations. The lower portions of the VW screen and some of the deeper VMPs may become submerged during periods of exceptionally high water levels. Preliminary data suggest that the water table at this test site may fluctuate 4 to 5 feet on a seasonal basis.

2.1.4 Site Contaminants

The primary contaminants at Building 97 Pump House are petroleum hydrocarbons, which have been detected in the soils at depths up to 10 feet bgs. Soil headspace VOCs were detected with a PID in concentrations up to 3,311 ppm and with a total hydrocarbon analyzer at greater than 20,000 ppm. Volatile organic BTEX compounds are confirmed in soils at the test site, and VOCs are potentially found in groundwater as well. Soil TPH concentrations up to 1,180 mg/kg were detected in recent sampling events. Concentrations of jet fuel by GC analysis were detected up to 24,000 mg/kg. The only suspected source of these contaminants is JP-4 jet fuel.

3.0 SITE SPECIFIC ACTIVITIES

This section describes the proposed location of the vent wells (VWs) and vapor monitoring points (VMPs) at Building 97 Pump House. Soil sampling procedures and the blower configuration that will be used to inject air (oxygen) into contaminated soils

are also discussed in this section. The two 4-inch air injection wells may be completed several feet into groundwater if the water table is elevated during installation. Vent well design will ensure that a portion of the screen remains above the water table throughout the year. No monitoring wells exist at the site to use as background vapor monitoring points. Because geotechnical boring logs have described organic soil layers on this part of the base, a temporary background VMP will be installed in uncontaminated soils to measure the oxygen demand of non-fuel organics and any abiotic oxygen uptake.

3.1 Bioventing Test Design For Building 97 Pump House

A general description of criteria for siting a central venting well and vapor monitoring points are included in the bioventing protocol document. Figure 3.1 illustrates the proposed locations of the vertical air injection VWs and VMPs at the site. The VWs and VMPs will be located in the most fuel-contaminated and oxygen-deficient soils at the test site. ES anticipates that the pilot test site will be located within, or adjacent to, the UST hold at the pump house. The final locations of these wells may vary slightly from the locations shown in Figure 3.1 based on site conditions encountered during the well installations. Additional soil gas screening will also be performed prior to VW installations to ensure that the test plot is located in oxygen-depleted soils.

Considering the shallow depth of contamination in unsaturated soils at this site (< 5 feet bgs), the soil lithology, and the VW construction required to accommodate shallow water table conditions, the radius of venting influence around a single air injection well is expected not to exceed 30 feet. Further reductions in the estimated radius of influence may be expected during high water table conditions when the unsaturated VW screen interval is decreased. A primary concern at this site is possible short-circuiting of injected air at the ground surface, resulting in a loss of the effective radius of venting influence. Short-circuiting potential is increased as the air injection pressures and/or air flow rates are increased, and as the unsaturated soil column thickness is decreased. For this reason, a multiple VW system (2 vent wells) will be installed. The dual VW system will allow a larger cumulative radius of influence to be maintained with lower injection pressures and air flow rates at the individual VWs.

Three VMPs will be located on 10-foot centers along the axis connecting the two VWs. The fourth VMP will be located perpendicular to this axis (see Figure 3.1). The VWs will be installed 40 feet apart so that their radii of venting influence will overlap near the center VMP. A temporary VMP will be installed in uncontaminated soils using a soil gas probe. The temporary VMP will be utilized to measure background levels of oxygen (O_2) and carbon dioxide (CO_2) and to determine if natural carbon sources (i.e. organic layers) or mineral reactions are contributing to oxygen uptake during the *in-situ* respiration tests. A respiration test will be conducted at the temporary VMP only if background O_2 concentrations are less than 18 percent. Additional details on the *in-situ* respiration test are found in Section 5.7 of the protocol document.

A mobile drill rig will be used to advance the VW boreholes and to collect split spoon soil samples. The air injection VWs will be constructed of 4-inch (ID) Schedule 40 PVC, with 5 feet of 0.02-inch slotted screen per well. High-yield well screens may

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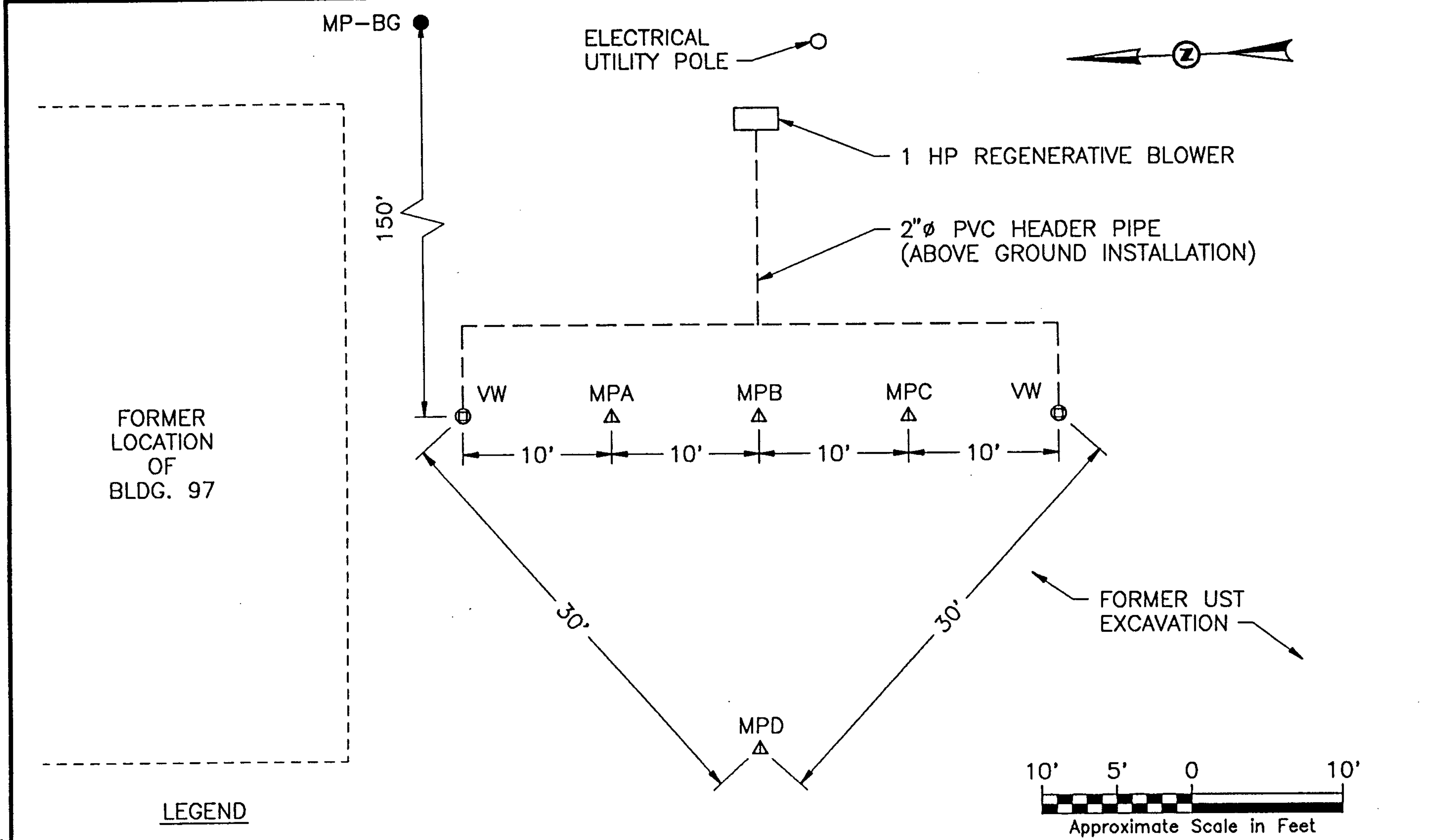

LEGEND

VW ⊕ Proposed air injection vent well.

MPA △ Proposed soil vapor/pressure monitoring point.

MP-BG ● Proposed background monitoring point.

Note: Final location of bioventing system may vary from the location depicted above. The relative configuration of VWs and MPs will remain unchanged.

Proposed Vent Well and Monitoring Point Locations

Building 97 Pump House
Charleston A.F.B.
Charleston, South Carolina

Figure 3.1

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be used to increase air flow rates and to decrease backpressure created at the well screen. Each VW will be installed to an approximate total depth of 9 feet bgs, with the screened interval extending from 4 feet to 9 feet bgs. A PVC casing will be installed above the screen, with approximately 4 feet bgs and a 2-foot stickup. Flush-threaded PVC casing and screen will be used with no organic solvents or glues. A filter pack of coarse silica sand will be placed around the screen in the borehole annulus. A bentonite pellet seal and grout seal will be placed above the filter pack to seal the borehole. A complete seal is critical to prevent injected air from short-circuiting to the surface during the bioventing test. A crown of clean, backfill soil will be mounded around the casing stickup to promote surface drainage away from the VW and to minimize possible air losses around the well casing. Figure 3.2 illustrates a typical air injection VW construction for this site.

A typical multi-depth VMP installation for this site is shown in Figure 3.3. The VMPs will be installed using 4-inch diameter hand augers. Soil gas O_2 and CO_2 concentrations will be monitored at depth intervals of 3-3.5 feet and 6.5-7 feet at each VMP location. These proposed monitoring depths assume that the seasonal high water table may be as high as 4 feet bgs in the test area. It is possible that the deeper screened intervals may be submerged during high water table conditions. If it is apparent that the water table will be exceptionally high even during the summer months (i.e. less than 6 feet bgs), then only the shallow VMP screen (3-3.5 feet) will be installed.

Multi-depth monitoring will confirm that the entire soil profile is receiving oxygen and will be used to measure fuel biodegradation rates at both depths. The annular space between these two monitoring points will be sealed with bentonite to isolate the monitoring intervals. Data from the temporary, background vapor monitoring point will also be used to determine the relative natural diffusion of atmospheric oxygen into the shallow soils. Additional details on vapor monitoring point construction are found in Section 4 of the protocol document.

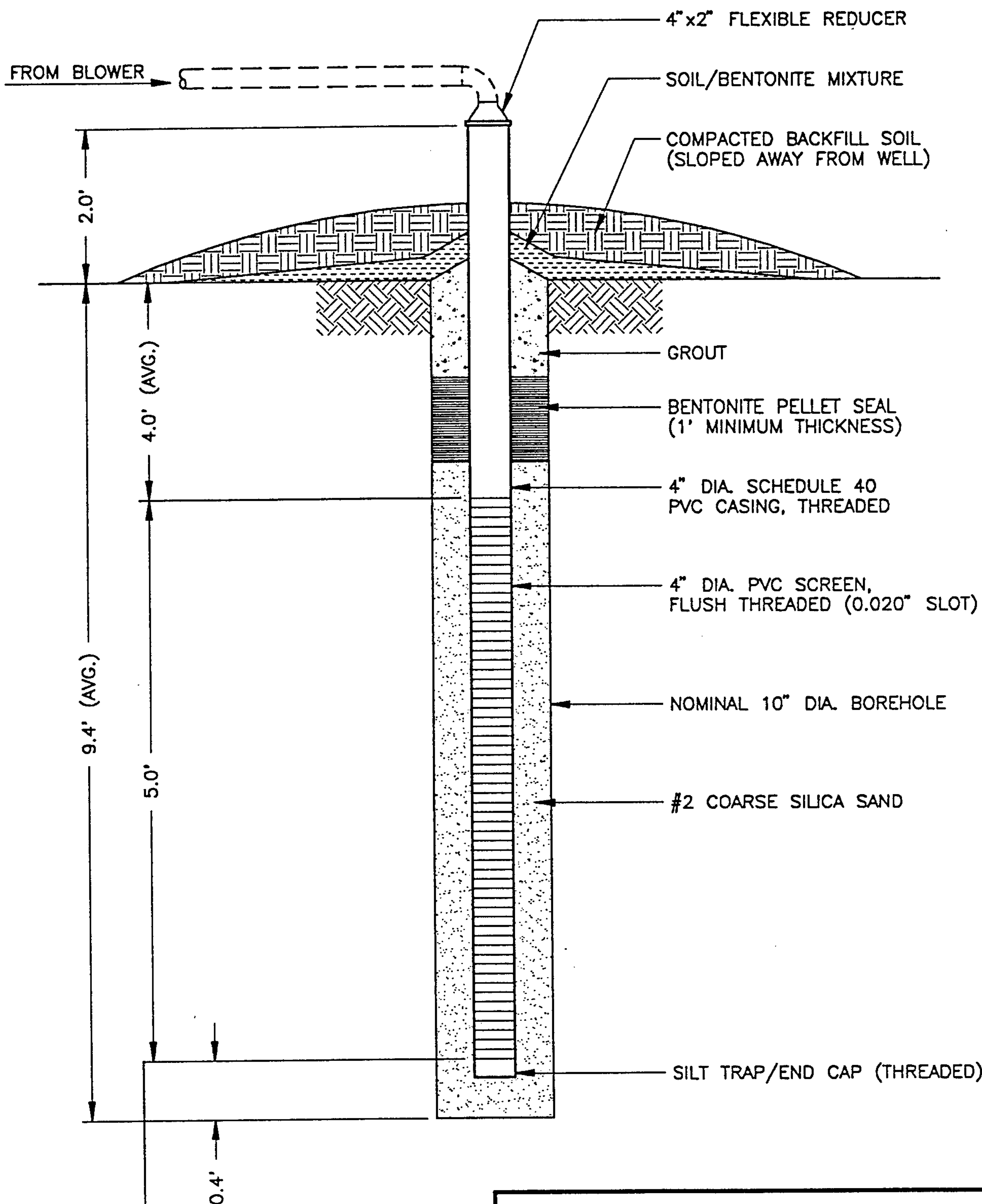
3.2 Soil and Soil Gas Sampling

3.2.1 Soil Sampling

Three soil samples will be collected from the pilot test area during the installation of the VWs and VMPs. Sampling procedures will generally follow those outlined in the protocol document, with minor modifications for collecting samples using a hand auger or split spoon sampler. One sample will be collected from the most contaminated interval of one VW. One soil sample will be collected from the interval of highest apparent contamination in two of the borings for the VMPs. Soil samples will be analyzed for TPH, BTEX, soil moisture, pH, particle sizing, alkalinity, total iron and nutrients.

Samples will be collected from the VMPs by hand augering to the desired sampling depth and transferring the soil sample directly from the hand auger bucket to the sample jars. A PID or total hydrocarbon vapor analyzer (see protocol Section 4.5.2.) will be used to insure that breathing zone levels of volatiles do not exceed 1 ppmv while conducting soil borings and to screen soil samples for relative fuel contamination. Soils from the most contaminated interval of the VMPs and VW will be submitted for laboratory analyses. Soil samples will be labeled following the nomenclature specified

Figure 3.2



NOTES:

1. Drawing is not to scale.
2. Header pipe from blower (dashed line) will not be installed during well construction.

Proposed Injection Vent Well Construction

Building 97 Pump House
Charleston A.F.B.
Charleston, South Carolina

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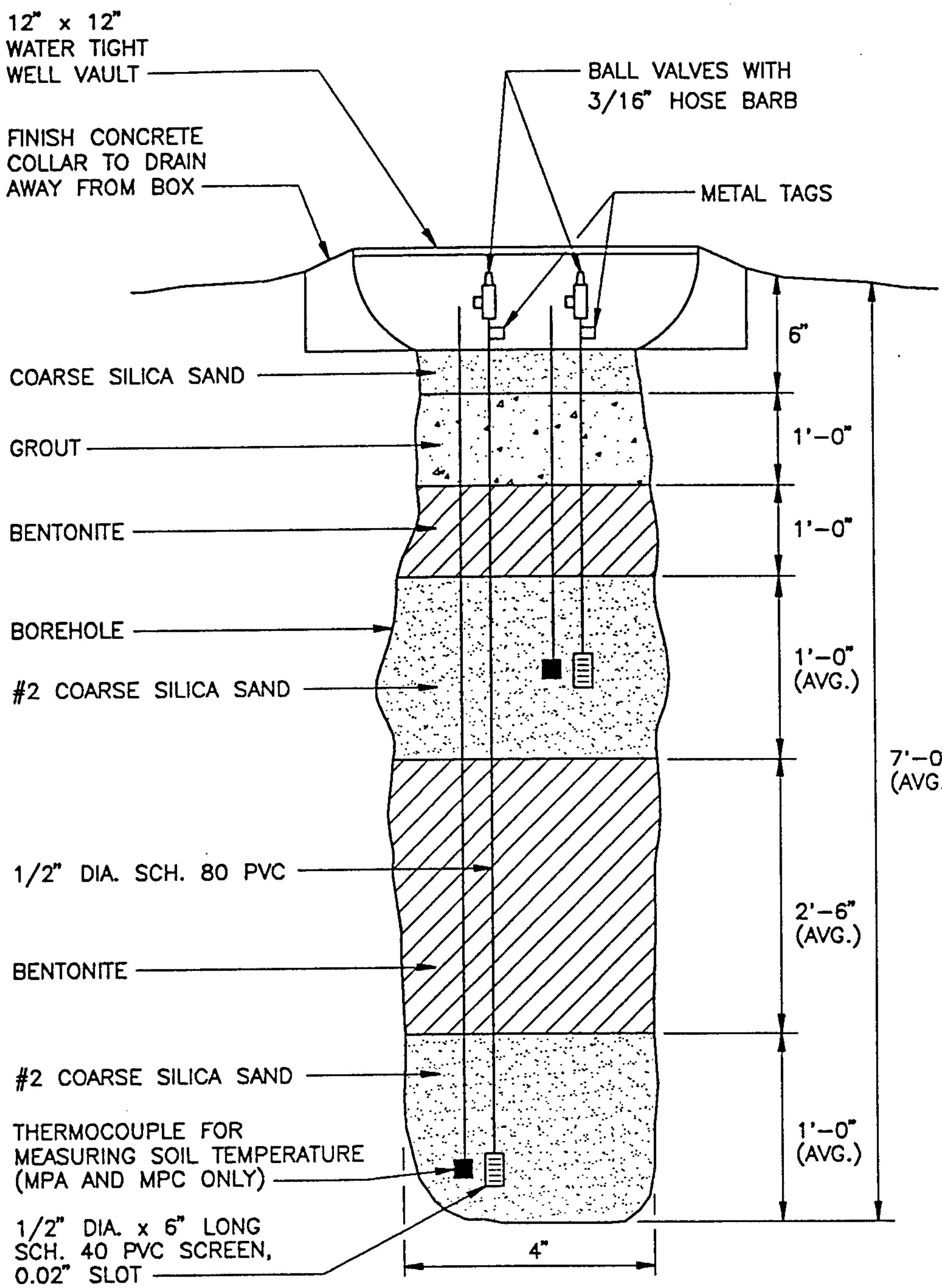
Figure 3.3



DRAWING IS NOT TO SCALE

Typical Monitoring Point
Construction Detail

Building 97 Pump House
Charleston A.F.B.
Charleston, South Carolina

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in the protocol document (Section 5.5), wrapped in protective plastic, and placed in an ice chest for shipment. A chain of custody form will be filled out and the ice chest shipped to PACE Laboratory in Novato, California for analysis. This laboratory has been audited by the U.S. Air Force and meets all quality assurance/quality control and certification requirements for the State of California.

3.2.2 Soil Gas Sampling

A total hydrocarbon analyzer (see protocol document, Section 4.5.2) will be used during the soil borings to screen sample intervals for fuel contamination. Once the monitoring points are installed and adequately purged, soil gas samples will be collected using SUMMA[R] canisters. Three SUMMA[R] canister soil gas samples will be collected, one from the most contaminated VW and one each from the VMPs closest to and furthest from the VWs. Quantitative soil gas samples will be used to predict potential air emissions, to determine the reduction of BTEX and total volatile hydrocarbons (TVH) during the extended test, and to detect potential migration of these vapors from the source area.

Soil gas samples will be placed in a small box and packed with foam pellets for protection during shipment. Samples will not be placed on ice to prevent condensation of hydrocarbon compounds. A chain-of-custody form will be completed and shipped with the samples to the Air Toxics, Inc. laboratory in Folsom, California. The soil gas samples will be analyzed for BTEX compounds and TVH.

3.3 Blower System

A 1-HP vacuum blower (Gast model 2067-P106) capable of injecting 16 scfm at 2 psi will be used to conduct the initial air permeability test at this site. Air injection will be used to provide oxygen to soil bacteria and to minimize emissions of volatiles to the atmosphere. If initial testing indicates that less pressure and air flow is required to supply oxygen throughout the test area soil column, a smaller blower will be installed for extended testing. Figure 3.4 is a schematic of a typical air injection system that will be used for pilot testing at this site.

The maximum power requirement anticipated for this pilot test is a 230-Volt, single-phase, 30 Amp service. ES understands that electrical power was removed from this site during facility demolition. Electrical service will be restored to the site through the installation of step-down transformer. Although only 30-Amp service is needed to operate the single test blower, ES recommends that the base install 100-Amp service to this site to support future equipment installations associated with site remediation. Additional details on power supply requirements are described in Section 5.0, Base Support Requirements.

4.0 EXCEPTIONS TO PROTOCOL PROCEDURES

The testing procedures that will be used to measure the air permeability of the soil and *in-situ* respiration rates are described in Sections 4 and 5 of the attached protocol document. No deviations from the established testing protocol are anticipated.

One exception to the typical test designs presented in the protocol document is the installation of two vent wells. This design is necessary to maximize the radius of oxygen influence throughout the test area and to minimize potential short-circuiting of

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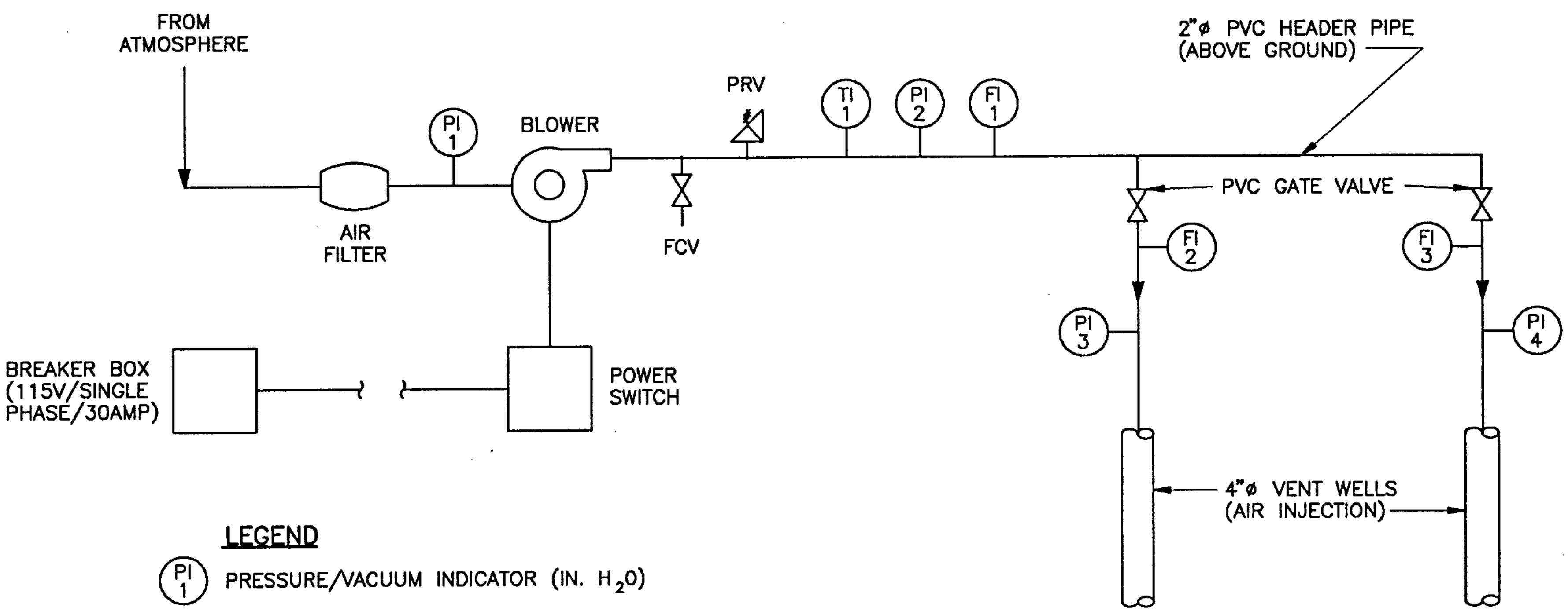

LEGEND

PI 1 — PRESSURE/VACUUM INDICATOR (IN. H_2O)

TI 1 — TEMPERATURE INDICATOR (°F)

FI 1 — AIR FLOW MEASURING PORT

FCV — FLOW CONTROL VALVE (MANUAL AIR BLEED)

PRV — PRESSURE RELIEF VALVE (AUTOMATIC)

NOTE: Blower diagram shown is for permanent installation for extended testing. A low-flow vacuum pump is proposed for the initial air permeability and respiration tests.

DRAWING IS NOT TO SCALE

Blower System Instrumentation Diagram for Air Injection

Building 97 Pump House
Charleston A.F.B.
Charleston, South Carolina

Figure 3.4

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air. Air flow rates to individual wells can then be reduced without affecting the test results. The VW screens may also be installed several feet into the water table if water levels are elevated during installation.

Soil borings for VMP installations will be advanced using a hand auger at this site. Since a drill rig will not be used, the typical borehole diameter for each monitoring point will be approximately 4 inches, as illustrated in Figure 3.3.

5.0 BASE SUPPORT REQUIREMENTS

5.1 Test Preparation

The following base support is needed prior to the arrival of an excavation contractor and the Engineering-Science test team:

- Confirmation of regulatory approval for the pilot test.
- Assistance in obtaining a digging permit at the Building 97 Pump House site.
- A breaker box mounted to a power pole on the site which can supply 230-Volt, Single-Phase 30 Amp service for the initial and extended pilot test. The breaker box should be located five feet above the ground and include one 230-Volt outlet and two 110 volt outlets to support pilot testing equipment. The base should also provide assistance in wiring the permanent blower directly to a power switch and to the breaker box.
- Provide any paperwork required to obtain gate passes and security badges for approximately two ES employees and three drilling contractor employees. Vehicle passes will be needed for three trucks.

  Arrange for flightline security training for two ES employees for unescorted access to the Building 97 Pump House site. Also, arrange for flightline training for applicable subcontractors if ES or base personnel are not allowed to escort subcontractors to the work area.

During the initial three-week pilot test, the following base support is needed:

- Twelve square feet of desk space and a telephone in a building located as near to the site as practical.
- A decontamination pad where the drilling contractor can clean the drill rig and augers.
- Accept responsibility for soil cuttings from vent wells and monitoring point borings, including any drum sampling to determine hazardous waste status.
- The use of a fax machine for transmitting 15 to 20 pages of test results.

During the one year extended pilot test at Building 97 Pump House:

- Check the blower system at the site once a week to ensure that it is operating and to record the air injection pressures at each VW. Engineering-Science will provide a brief training session and an O&M checklist for this procedure.

- Notify Mr. Grant Watkins, Engineering-Science, Inc., Cary, NC (919) 677-0080; or Mr. Doug Downey, Engineering-Science, Inc. Denver (303) 831-8100; or Mr. Marty Faile of the AFCEE, (210) 536-4342, if the blower or motor stop operating.
- Arrange site access for an Engineering-Science technician to conduct *in-situ* respiration tests approximately six months and one year after the initial pilot test.

5.2 Permit Requirements

Base personnel are responsible for obtaining all permits from the South Carolina Department of Health and Environmental Control (SCDHEC) that are required to perform the test as described in this work plan. If required, Engineering-Science will assist this effort by providing test design criteria and reference documents for regulatory review. Unless directed by AFCEE or the Charleston AFB POC, no direct contact will be made between Engineering-Science and the regulatory agencies.

Based on preliminary review of the test procedures and previous experience at the base, the SCDHEC will require an Underground Injection Control (UIC) Permit to perform any air injection into the subsurface. This permit will regulate the vent wells as a Class V.A.-G injection well system. The permit will be required for both the short-term air permeability/respiration tests and the extended bioventing test. Therefore, the proposed test schedule is dependent on timely permit approval by SCDHEC. The Agency will also issue approval for construction of the VMPs and the vent wells.

6.0 PROJECT SCHEDULE

The following schedule is contingent upon timely approval of this pilot test work plan:

Event	**Date**
Draft Test Work Plan to AFCEE/Charleston AFB	October 13, 1993
Approval To Proceed	October 20, 1993
Begin Initial Pilot Test	November 8, 1993
Complete Initial Pilot Test	November 17, 1993
Interim Results Report	December 22, 1993
Respiration Test	May 1994
Final Respiration Test	November 1994

After a period of one year, a decision will be made by AFCEE and the base to either remove the system or to expand the system for full-scale remediation at the site.

7.0 POINTS OF CONTACT

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8.0 REFERENCES

Westinghouse, Inc., *Report of Geotechnical Engineering and Environmental Services, ADAL Apron/Hydrant Fuel System, Charleston Air Force Base, North Charleston, South Carolina.* November, 1991.

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